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I. E. MOUROMTSEFF ET AL

2,394,398

COAXIAL LINE SEAL

Filed March 20, 1942

Fig. 1.

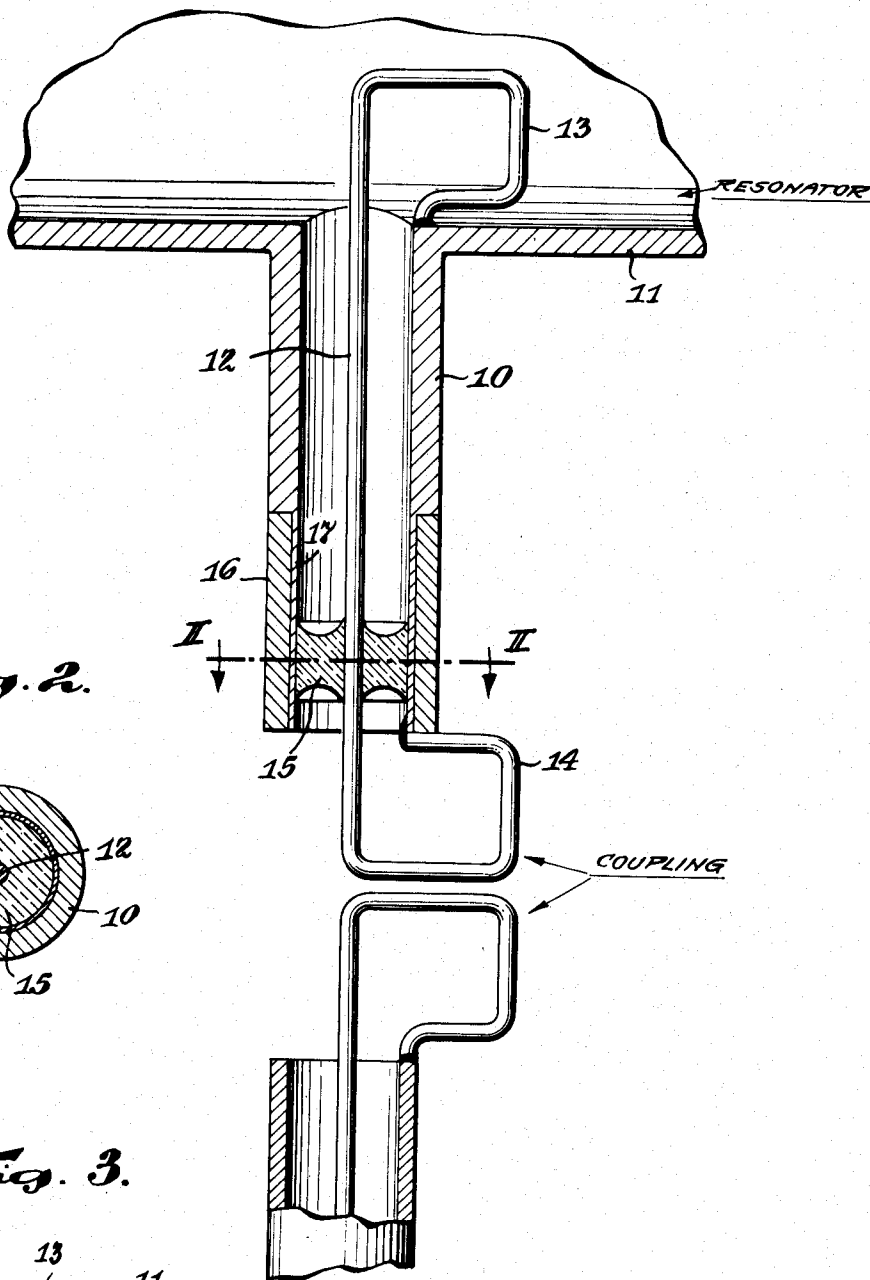


Fig. 2.

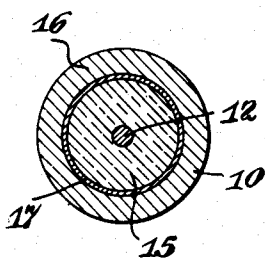
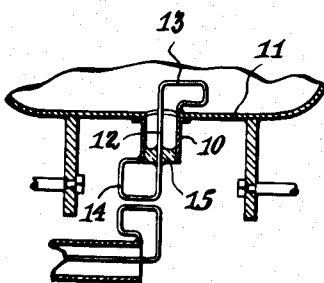


Fig. 3.



INVENTORS
I. E. MOUROMTSEFF
G. M. DINNICK
BY
J. W. Greenhouse
ATTORNEY

UNITED STATES PATENT OFFICE

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COAXIAL LINE SEAL

Illa E. Mourontseff, Montclair, and George M. Dinnick, Bloomfield, N. J., assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application March 20, 1942, Serial No. 435,504

5 Claims. (Cl. 174-19)

This application is, as to basic subject matter, a division of our co-pending application Serial No. 360,367, filed October 9, 1940, for "Ultra-high frequency oscillator," now issued as Patent No. 2,283,895 under date of May 19, 1942. The invention of the present application is directed particularly to the concentric or coaxial line construction utilized in transmitting the wave energy. Both the broad concept of said co-pending application and an improved species are here shown.

An object of the present invention is to provide a transmission line presenting minimum obstacle to free passage of the wave energy.

Another object of the invention is to obtain adequate sealing of the tubular and rod portions of the coaxial line away from the ends of both said portions.

A further object of the invention is to enable a coaxial line to be vacuum sealed and at the same time permit attachment of the loop end of the rod to the extreme end of the tube.

Yet another object of the invention is to insure maximum conductivity of the tube combined with physical strengthening of the tube and seal.

Again, an object of the invention is to provide a seal controlled in expansion such that the tube and glass seal have substantially the same coefficient at the region of the seal but with a good conductor passing the seal to the end of the tube.

Still further objects of the invention will appear to those skilled in the art as the description progresses, both by direct statement thereof and by implication from the context.

Referring to the accompanying drawing in which like numerals of reference indicate similar parts throughout the several views;

Figure 1 is a sectional view of a concentric or coaxial line output from a resonator embodying our invention;

Figure 2 is a cross section thereof on line II-II; and

Figure 3 is a partial section from the said co-pending application showing the broad concept of the invention.

In the specific embodiment of the invention illustrated in said drawing, the reference numeral 10 designates the tubular portion, preferably of copper or other good electrical conductor, of a transmission line which may be part of or projects from a source of wave generation, such as from the metallic shell 11 of a hollow-body resonator forming part of a high frequency wave generator of the character shown in our said co-pending application. Extending coaxially within tube 10 is a rod or center conductor 12 having an inner loop

13 in the resonator and an outer loop 14 constituting an output coupling and shown entirely outside of the tube in the open atmosphere. The inner loop and inner portion of the rod 12 are subject to the vacuum of the resonator, and a seal 15 is accordingly made between the rod and tube wall to maintain the vacuum.

As shown, the seal 15 is constituted by a plug of glass which is within the outer end of the tube so the end edge of the said tube will be exposed and unobstructed by any sealing means. The end of the output loop 14 may therefore be secured, as by soldering, welding, or otherwise, to the extreme end of the tube. Attachment to the extreme end of the tube is important, since the current flows on the inside surface of the tube. This gives opportunity of making connection without any sudden changes in the flow or no doubling back in the flow path to pass to the loop.

The above description applies to all figures of the drawing. Referring now to Figures 1 and 2 more specifically it is to be observed that the outer end of the coaxial line tube 10 which is the part thereof containing the sealing plug 15, is constructed in two parts. There is an outer part or collar 16 the coefficient of expansion whereof preferably approximates that of the plug. Slight tendency of greater expansion of the plug than of the collar is preferred, so any tension set up will be compressive at the joint. The material of which said collar is formed is preferably of greater strength than the copper portion of the tube, and may well be an alloy of composition essentially of nickel, cobalt and iron sold under the trade name of "Kovar" and the plug is preferably of borosilicate glass, details of both of which are given in Patent 2,062,335 to Scott, of December 1, 1936.

The conductivity of "Kovar" is very considerably less than copper. A feature of the present invention resides in the use of "Kovar" for its strength and desirable coefficient of expansion, and at the same time in obtaining the benefit of conductivity of copper. Accordingly the tube is formed to provide a part constituting a thin, cylindrical inner skin or sleeve 17 of copper within the collar 16 upon the inside surface thereof. This copper sleeve part of the tube may be an integral continuation of the more rugged body of the tube but of reduced thickness, or may be plated or otherwise formed in place. It is characterized by its thinness of wall thickness and its good electrical conductivity together with ductility or flexibility such that it will follow the expansion and contraction of the surfaces with which it is engaged or attached. Said sleeve is interposed be-

tween the "Kovar" collar and the plug and, extending from the main body of tube 10 to the outer end of the collar, forms an electrical conductive path along the inside of the collar to the loop at the outer end thereof. While we specifically refer to a loop as a part of the conductive means at the end of the "Kovar" collar and beyond the plug, it is to be understood other transmission means than that may be employed if found preferable.

The construction and beneficial results obtained by the disclosure of Figures 1 and 2 are characterized by the security of seal of the tube by its controlled expansion and contraction substantially equal to that of the plug, by the strengthening presence of the "Kovar" collar, and by the advantageous high order of conductivity of the copper tube and its extension or sleeve throughout the length of the tube and to the outer end thereof. Furthermore the inventive concept includes the provision of a seal within the tube by which it becomes now practical to attach the loop at the physical end of the tube and thereby avoid any doubling back of the flow path to pass to the loop.

Since the various details of construction as well as the precise relation and functioning of parts are subject to variation and change without departing from the inventive concept or scope of the invention, it is intended that all matter contained in the specification or illustrated in the drawing, shall be interpreted as exemplary and not in a limiting sense. It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein shown and described and all statements of the scope of the invention herein set forth as a matter of language which might be said to fall therebetween.

We claim:

1. A coaxial line seal comprising a conductive tubular portion, a conductive rod extending therethrough, a reenforcing collar around a part of the tubular portion, and an insulative plug within the part of the tube surrounded by the collar, said plug being sealed to both the tubular portion and to the rod.
2. A coaxial line seal comprising a conductive tubular portion, a conductive rod extending therethrough, said rod being looped at its outer end and secured to the end of the said tubular portion, and an insulative plug situated within said tubular portion clear of said end thereof and sealed to both the inside surface of the tubular portion and to said rod.
3. A coaxial line seal comprising a tubular portion of highly conductive material of the character of copper and having embedded as a part thereof a collar of material stronger than copper and characterized by a different coefficient of expansion, a rod conductor extending through the tubular portion, and a plug within the collar sealing the passage therethrough around the rod conductor, said plug being situated within said collar and having substantially the same coefficient of expansion.
4. A coaxial line seal comprising a tubular portion of highly conductive material of the character of copper and having embedded as a part thereof a collar of material less conductive electrically and physically stronger than said conductive material of the tubular portion, said conductive material of the tubular portion being continuous from end to end of said tubular portion and projecting beyond one end of the said collar, and a sealing plug for the passage through said tubular portion, said plug being within the confines of said collar.
5. A coaxial line seal comprising a tubular portion of highly conductive material of the character of copper and characterized by ductility, said tubular portion having a part thereof reduced in thickness and comprising a thin wall sleeve, a plug in the sleeve passage of said tubular portion sealed to the said thin wall of the sleeve, and a collar of different material around said sleeve having substantially the same coefficient of expansion as the plug, said sleeve thereby having an annular part thereof between said collar and plug and by virtue of its thinness and ductility responding to the expansion and contraction of said collar and plug and maintaining a tight seal with the plug.

ILIA E. MOUROMTSEFF.
GEORGE M. DINNICK.

Disclaimer

2,394,398.—*Ilia E. Mouromtseff*, Montclair, and *George M. Dinnick*, Bloomfield, N. J. COAXIAL LINE SEAL. Patent dated Feb. 5, 1946. Disclaimer filed Jan. 31, 1951, by the assignee, *Westinghouse Electric Corporation*.

Hereby enters this disclaimer to claim 1 in said specification.
[*Official Gazette February 27, 1951.*]

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